

# PTSD in WWII Mustard Gas Test Participants

## A Preliminary Report

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During World War II, the United States military conducted secret tests of the effectiveness of various strategies for protecting combatants against the effects of mustard gas and Lewisite, which cause blisters and other tissue damage and can be fatal. At least 4,000 men were extensively exposed to these agents<sup>1</sup> while participating in tests of protective clothing, either by being placed in a sealed room into which a chemical was introduced (a *chamber* test) or by traversing a contaminated area (a *field* test). Until recently, participants' experiences were not known because most had been sworn to secrecy and had kept their oath. When the testing became public knowledge in 1990, it appeared that many men had had significant medical and psychological problems as a result of participation and that their rights as human subjects had not been protected.

In 1992, the Department of Veterans Affairs (VA) began to allow compensation for cancers, ophthalmological problems, and respiratory problems that may have been caused by mustard gas. Psychiatric disorders were not included in the list despite the conclusion of an investigation by the National Academy of Sciences that posttraumatic stress disorder (PTSD) and other psychiatric disorders may have resulted from the gas exposure. The National Academy of Sciences also recommended that the VA study the issue. Following the Academy's recommendation, we assessed PTSD and other psychosocial outcomes in a sample of WWII mustard gas test participants.<sup>2</sup>

## METHOD

We randomly sampled 250 Army and 250 Navy veterans from a registry developed for a mortality study of mustard gas test participants that is being conducted by the

VA's Office of Public Health and Environmental Hazards. Those alive as of October 1995 were considered to be the study population. Of the 500 men, 363 (72.6%) participated; 15% could not be located, 7.6% were ineligible or dead, 2.6% could not be scheduled, and 2% refused. Of those located and eligible, 93.8% participated.

At the time of study, participants' average age was 72 years. Almost all were White (98%), although 10% reported Hispanic ethnicity. Most were married (83%), were retired (78%), and had at least a high school education (64%).

Members of an experienced survey research team interviewed participants by telephone. The assessment battery included questions about: mustard gas test experiences; current and lifetime PTSD related to mustard gas; exposure to war zone trauma and other traumatic events; current health, well-being, and social support; and demographic background. Only results on PTSD prevalence and risk factors are presented here.

Mustard gas-related PTSD was assessed by the PTSD Checklist, which asks for ratings of the 17 DSM-IV PTSD symptoms on a 5-point scale. It has excellent convergence with a diagnosis based on structured clinical interview.<sup>3</sup> A symptom was scored as present if it was rated 3 or higher, indicating at least moderate levels (Weathers, personal communication, July 1996). Current PTSD prevalence indicates the percentage of men who met DSM-IV diagnostic criteria in the last month; lifetime prevalence indicates the percentage who ever had PTSD.

## RESULTS

All of the analyses presented herein are preliminary. We used the chi-square test for comparisons between Army and Navy subgroups; Wilcoxin and Fisher's exact tests were used when indicated. Prevalence estimates for current and lifetime PTSD are presented with 95% confidence intervals in parentheses. Risk factors for current PTSD are presented as crude (unadjusted) odds ratios. The reference category for most variables is the group that did not have the factor, for example, not having volunteered for "volunteered." The reference category for timing of disclosure is "before 1991." There are small amounts of missing data for some variables. For several variables a sizable number of men, roughly 20 in each instance, replied "don't know." Rather than treat these men as having missing data, we included them as a separate category.

TABLE 1 presents information on the mustard gas test experiences of Army and Navy subgroups. The subgroups differed in many ways. Army veterans were more likely to have participated in a field test, whereas Navy veterans were more likely to have participated in a chamber test. Navy veterans were more likely than Army veterans to have a higher number of exposures, to have volunteered, to have experienced intense distress during the tests, to have been sworn to secrecy, and to have disclosed after the media exposure of the mustard gas story in 1990. Army veterans were more likely than Navy veterans to have experienced burns and loss of consciousness during the test.

The prevalence of current PTSD was 32% (27%, 37%) and the prevalence of lifetime PTSD was 37% (32%, 42%). Navy veterans were more likely than Army veterans to have current PTSD: prevalence was 37% (30%, 43%) in Navy veterans

TABLE 1. Characteristics of Mustard Gas Test Experiences by Branch of Service

	Army	Navy	Total
Participated in field test (% yes)	70.6	4.8	33.5***
Participated in chamber test (% yes)	58.0	98.4	80.3***
Volunteered for test (% yes)	71.3	87.1	79.9***
Total number of exposures**			
1-2	41.4	30.3	35.3
3-6	29.0	25.6	27.2
7+	19.8	38.0	29.7
Don't know	9.9	6.2	7.8
Felt life was in danger during test			
% Yes	19.3	21.4	20.4
% Don't know	5.4	10.4	8.1
Physical symptoms during testing (% yes)			
Eyes or skin burned	30.3	14.3	21.6**
Difficulty breathing	36.7	45.1	41.4
Nausea/vomiting	20.3	27.3	24.0
Failure to maintain consciousness	10.3	4.2	7.0*
Intense fear, helplessness, or horror during test	31.1	46.2	39.3***
Oath of secrecy/disclosure criminalized***			
% Yes	27.7	52.3	41.1
% Don't know	1.2	3.6	2.5
Timing of disclosure (%)***			
Up to 1990	60.0	57.4	58.6
1991 to present	9.7	24.4	17.7
Never disclosed	15.8	5.6	10.2
Don't know	14.6	12.7	13.5

\*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\* $p < 0.001$  for differences between Army and Navy subgroups.

and 26% (19%, 33%) in Army veterans ( $p < 0.05$ ). Navy veterans also were more likely than Army veterans to have lifetime PTSD: prevalence was 44% (37%, 51%) in Navy veterans and 28% (21%, 35%) in Army veterans ( $p < 0.01$ ). The mean number of current PTSD symptoms was 5.6 (SD 5.9) in both groups combined. On average, Navy veterans had 6.3 (SD 5.8) current symptoms and Army veterans had 4.7 (SD 6.0) current symptoms ( $p < 0.05$ ).

TABLE 2 presents risk factors for current and lifetime PTSD. Navy veterans were more likely than Army veterans to have current and lifetime PTSD. Having volunteered was associated with a decreased likelihood of both outcomes. The risk of current and lifetime PTSD was increased by severity of traumatic exposure, as indicated by the number of exposures, feeling one's life was in danger, number of physical symptoms, and intense distress. Aspects of disclosure also were associated with the likelihood of PTSD. Risk of current and lifetime PTSD was increased among men who were sworn to secrecy or told that disclosure would be a criminal act, relative to those who were not. Having disclosed after the story became public knowledge was associated with increased risk of current PTSD.

TABLE 2. Risk Factors for Current and Lifetime PTSD

	Current		Lifetime	
	OR	95% CI	OR	95% CI
Branch of service				
Army	1.00		1.00	
Navy	1.65*	1.05, 2.59	2.06**	1.33, 3.21
Recruitment for test				
Did not volunteer	1.00		1.00	
Volunteered	.27***	.16, .47	.28***	.16, .48
Number of exposures				
1-2	1.00		1.00	
3-6	3.06***	1.70, 5.52	2.89***	1.63, 5.11
7+	2.06*	1.15, 3.71	2.27**	1.29, 3.99
Don't know	1.82	.74, 4.49	2.40*	1.02, 5.63
Felt life was in danger during test				
No	1.00		1.00	
Yes	5.68***	3.25, 9.90	5.00***	2.87, 8.69
Don't know	4.01***	1.82, 8.81	2.96**	1.36, 6.46
Physical symptoms during test (per sx)	2.95***	2.25, 3.88	3.40***	2.55, 4.53
Intense fear, helplessness, or horror during test				
No	1.00		1.00	
Yes	7.31***	4.45, 11.99	6.77***	4.21, 10.89
Oath of secrecy/disclosure criminalized				
No	1.00		1.00	
Yes	3.64***	2.28, 5.82	4.11***	2.60, 6.51
Don't know	2.00	.48, 8.34	2.69	.69, 10.42
Timing of disclosure				
Up to 1990	1.00		1.00	
1991 to present	2.04*	1.15, 3.62	1.65	.94, 2.90
Never disclosed	.64	.28, 1.47	.46	.20, 1.04
Don't know	.84	.42, 1.68	.60	.30, 1.19

Note: OR = odds ratio; CI = confidence interval. \*  $p < 0.05$ ; \*\*  $p < 0.01$ ; \*\*\*  $p < 0.001$ .

## DISCUSSION

We have shown that roughly one third of men who were exposed to mustard gas or Lewisite in secret tests during WWII developed PTSD. We also have shown that the likelihood of PTSD varies markedly as a function of individual differences in variables that capture participants' experiences before, during, and after the tests. Our results are generally consistent with both theory and other data on risk factors for PTSD, although some bear further scrutiny, for example, having never disclosed about the tests, which we would expect to increase the likelihood of PTSD, was nonsignificantly protective. We are conducting further analyses to better understand

our findings and to explore the unique influences on PTSD prevalence that are associated with each risk factor.

### REFERENCES

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